# Relative Momentum:
# A New Alternative to Relative Strength

Gary Anderson

**Abstract**

Relative strength (RS) methodologies have gained in popularity over the last twenty years, in part due to academic studies as well as more popular accounts which have promoted their benefits. But as our understanding of markets advances, new methods, built on previous accomplishments, are bound to emerge. This paper presents Relative Momentum, one such step in an evolutionary process.

While in some ways a significant departure from RS, Relative Momentum (RM) is nonetheless grounded on market dynamics made evident by RS analysis. A review of an earlier study of RS is offered as a necessary foundation for the new work taken up in this paper. The relationship between feedback and the capital flows which generate RS is critical to an understanding of RM.

Traders' response to the global behavior of the system produces feedback which is either positive or negative. Positive feedback is constructive of trends, while negative feedback inhibits trend formation. A trend-following strategy is therefore likely to benefit from a close analysis of positive feedback.

To determine whether feedback is positive or negative, a universe of industry groups is plotted against a two-dimensional matrix. Relatively strong groups are separated from those which are relatively weak by a benchmark, in this case an industry group average. When feedback is positive, strong groups become stronger, weak groups become weaker, and capital is transferred from weaker into stronger groups. The opposite is true when negative feedback is the market dynamic.

Periods of positive feedback are followed by periods during which negative feedback directs the transit of capital. Flows may be tracked by computing the spread in relative strength from the strongest to the weakest groups. When the RS spread expands, positive feedback is in play, and when the indicator contracts, negative feedback controls capital flow.

Based on this analysis, the market is characterized as a dialectic, not of buyers and sellers, but of constructive and entropic forces. Constructive periods, those when positive feedback is the controlling dynamic, are responsible for generating price trends in either direction.

Traditional RS is computed over an entire price series, regardless of whether changes are the result of positive or negative feedback. RM separates out periods of negative feedback and focuses on just those when feedback is positive. Periods of positive feedback are tagged and price changes recorded. When applied to any group or stock, the technique reveals the direction in which momentum (positive feedback) is driving price. The Direction of Momentum (DOM) may be applied to any price series.

RM examines the relative performance of each group's DOM. To compute RM, first DOM is computed for each member of a set of groups. Then the relative performance of each DOM is determined by summing changes over some look-back period. In this study a six-month look-back is used. The result is Relative Momentum. RM leaders and laggards are determined and compared to the average group as well as to RS leaders and laggards, i.e., those computed using the full price series of each target.

An historical study of industry groups and stocks demonstrates that returns from RM techniques presented here significantly improve on more traditional RS methodologies.

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## Introduction

Traders have employed relative strength strategies for decades. In his 1933 bestseller, *The Seven Pillars of Stock Market Success*, George Seaman recommended that traders buy stronger stocks during an advance and short weaker stocks during declines. Thirty years later, George Chestnutt offered this advice to readers:

> Which is the best policy? To buy a strong stock that is leading the advance or to "shop around" for a "sleeper" or "behind-the-market" stock in the hope that it will catch up? . . . On the basis of statistics covering thousands of individual examples the answer is very clear as to where the best probabilities lie. Many more times than not, it is better to buy the leaders and leave the laggards alone. . . In the market, as in many other phases of life, "the strong get stronger, and the weak get weaker."[1]

Formal studies of the efficacy of relative performance date back to at least the mid-sixties with the publication of Robert Levy's ground-breaking book, *The Relative Strength Concept of Common Stock Price Forecasting.*[2] Levy concluded that "the historically strongest stocks produced the best future results, and the historically weakest stocks produced the worst." Levy found that stocks which evidenced superior relative-strength over a six month period produced better-than-benchmark results over the following six months, though shorter look-back periods produced positive results as well. These conclusions were echoed by Jegadeesh and Titman.[3] Their work showed that relative performance look-back periods of up to twelve-months provided better than average forward returns.

Perhaps as a consequence of these and later studies which drew similar conclusions, heuristic models employing relative performance have gained wide acceptance. A recent study of European money managers found that although few managers surveyed relied exclusively on a single method, preferences were roughly evenly divided among three strategic options: trend-following, contrarian, and buy and hold.[4] Another concluded that domestic fund managers "tend to buy stocks based on their past returns." Of the funds surveyed, a large majority (119) employed trend-following methods, while a significant but much smaller group (36) relied on contrarian strategies.[5]

In this paper I introduce Relative Momentum (RM). RM builds on the tradition of relative strength (RS), but, as we shall see, returns of RM exceed those available using RS methods. Part I first reviews a model of relative strength published in an earlier paper,[6] then through the lens of that model examines the feedback dynamics driving relative strength. Next, the concepts of relative-strength and feedback are fused to portray the market as a system of capital flows. On this foundation, Part II builds the concept of relative momentum and introduces procedures for computing RM. Finally, both RM and RS are tested and returns compared.

## Part I

## Foundations

There are two sorts of risk. The first is encountered during falling markets, when a trader's ability to defend capital against loss is most critically tested. But a rising market demands an effective offense, otherwise traders are subjected to yet another risk, lost opportunity.

Having identified two sorts of risks, defensive and offensive, we measure each against a benchmark. For our benchmark we sum the average returns of all target groups under analysis.[7]

Two sets of returns are calculated, one to measure a group's offensive performance and the other to measure defensive performance. Offensive returns include only those periodic benchmark returns which are greater than or equal to the benchmark's median return over the previous six months, while a second set of defensive returns includes the balance of the benchmark's returns, those less than the six-month median.

To illustrate this method, Figure 1 shows twenty hypothetical quarterly returns for the benchmark in column A. The median return of those twenty is 1.92. In column B, quarterly returns greater than or equal to 1.92 are logged, and the balance of the quarterly returns, those less than the benchmark median, are shown in column C.

Figure 1

| | A | B | C |
|---|---|---|---|
| | | | |
| | Benchmark | Offensive | Defensive |
| | Returns | Returns | Returns |
| | | | |
| 1 | 2.49 | 2.49 | |
| 2 | -4.23 | | -4.23 |
| 3 | 3.63 | 3.63 | |
| 4 | 1.87 | | 1.87 |
| 5 | -1.01 | | -1.01 |
| 6 | 5.76 | 5.76 | |
| 7 | 3.41 | 3.41 | |
| 8 | -2.16 | | -2.16 |
| 9 | -1.49 | | -1.49 |
| 10 | -0.85 | | -0.85 |
| 11 | 5.23 | 5.23 | |
| 12 | 0.03 | | 0.03 |
| 13 | 3.94 | 3.94 | |
| 14 | 4.19 | 4.19 | |
| 15 | -2.61 | | -2.61 |
| 16 | -0.05 | | -0.05 |
| 17 | 0.95 | | 0.95 |
| 18 | 3.85 | 3.85 | |
| 19 | 2.73 | 2.73 | |
| 20 | 1.97 | 1.97 | |

In Figure 2, three more columns are added. Column D shows hypothetical quarterly returns of a single industry group average. In columns E and F, the group's returns are separated in accordance with the division of benchmark returns. That is, if the benchmark's quarterly return falls under 'offense', the group's return is registered under 'offense' as well, otherwise the group's return is counted as 'defense'.

Figure 2

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| | | | | | | |
| | Benchmark | Offensive | Defensive | Group | Group | Group |
| | Returns | Returns | Returns | Returns | Offense | Defense |
| | | | | | | |
| 1 | 2.49 | 2.49 | | 3.67 | 3.67 | |
| 2 | -4.23 | | -4.23 | -1.34 | | -1.34 |
| 3 | 3.63 | 3.63 | | 5.54 | 5.54 | |
| 4 | 1.87 | | 1.87 | 0.89 | | 0.89 |
| 5 | -1.01 | | -1.01 | -2.06 | | -2.06 |
| 6 | 5.76 | 5.76 | | 6.76 | 6.76 | |
| 7 | 3.41 | 3.41 | | 3.70 | 3.70 | |
| 8 | -2.16 | | -2.16 | -3.54 | | -3.54 |
| 9 | -1.49 | | -1.49 | -1.07 | | -1.07 |
| 10 | -0.85 | | -0.85 | 0.96 | | 0.96 |
| 11 | 5.23 | 5.23 | | 3.62 | 3.62 | |
| 12 | 0.03 | | 0.03 | 2.16 | | 2.16 |
| 13 | 3.94 | 3.94 | | 2.69 | 2.69 | |
| 14 | 4.19 | 4.19 | | 6.71 | 6.71 | |
| 15 | -2.61 | | -2.61 | -3.84 | | -3.84 |
| 16 | -0.05 | | -0.05 | 0.19 | | 0.19 |
| 17 | 0.95 | | 0.95 | -0.43 | | -0.43 |
| 18 | 3.85 | 3.85 | | 2.75 | 2.75 | |
| 19 | 2.73 | 2.73 | | 5.37 | 5.37 | |
| 20 | 1.97 | 1.97 | | 0.83 | 0.83 | |

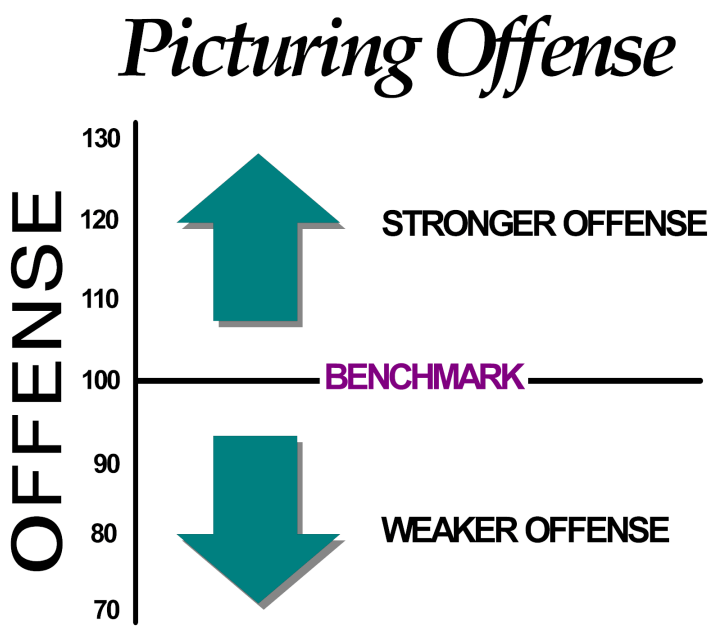
The sum of the benchmark's offensive returns over the five years is 37.20. That amount is divided into 41.64, the sum of the group's offensive returns for same quarters. A result of 1.12 is multiplied by 100 to arrive at the group's offensive score of 112. A score higher than 100 indicates that the group's offensive returns were better than the benchmark's over the same periods.

A similar computation is performed to determine the group's defensive score. The sum of the benchmark's defensive returns, -9.55, is divided into -8.08, the sum of the group's defensive returns. The group's defensive score is -8.08/-9.55, or .85. Again, that amount is multiplied by 100. In this case, a defensive score of 85 indicates that the group's losses were less than the benchmark's during periods of lower-than-median return.

Some better-performing groups excel through good defense--by losing less than the market as it falls. Other groups succeed by mounting a superior offense--by outrunning a rising market. The best groups typically combine superior offense with superior defense.

In Figure 3, the vertical axis displays offensive performance. A score above 100 indicates that the target group's offensive return exceeds the benchmark's over the same quarters. A weak offense underperforms the benchmark and earns a score below 100.

Figure 3




Defensive performance is shown along the horizontal axis (Figure 4). A strong defense scores less than 100, indicating that defensive losses, if any, are less than the benchmark's. On the other hand, a weak defense produces losses, if any, which are greater than the benchmark's over those same periods, indicated by a defensive score higher than 100.

Figure 4

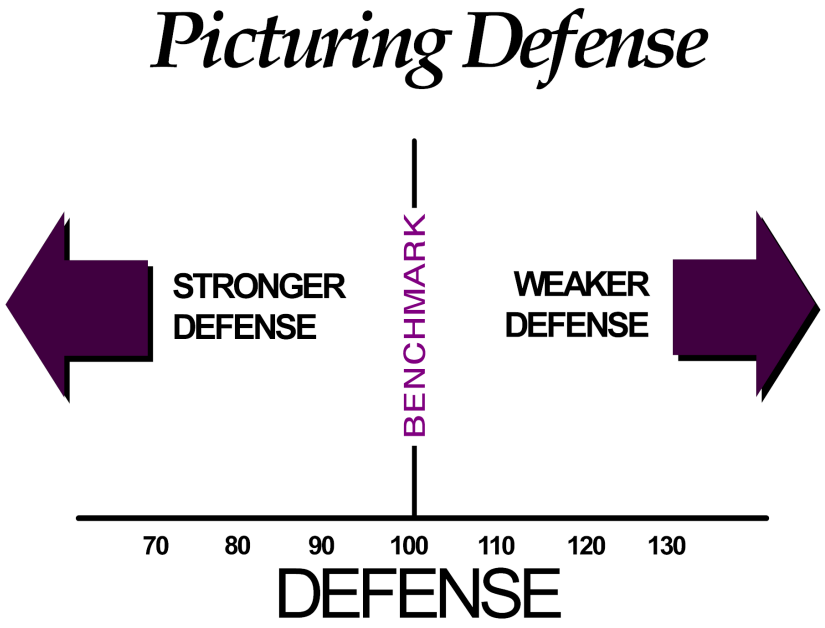
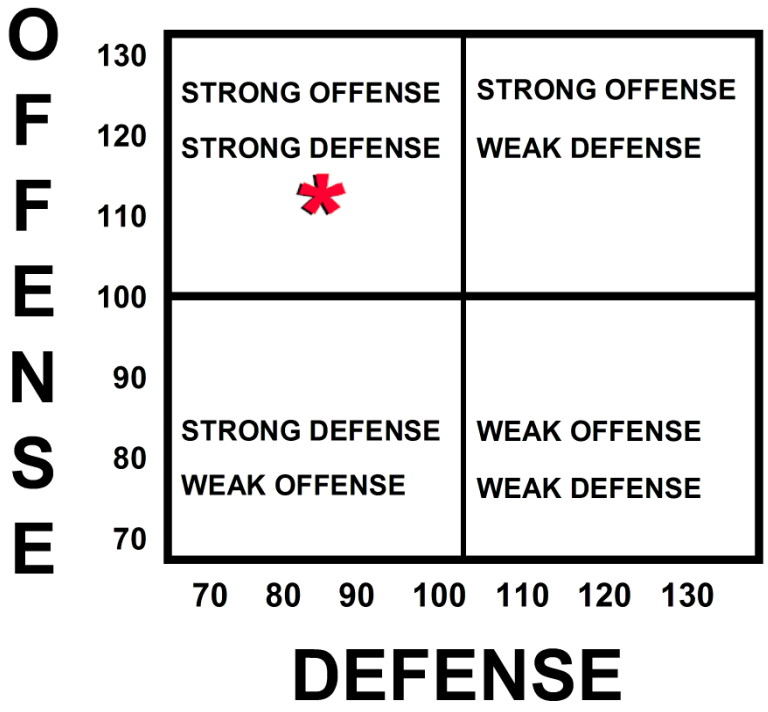



Figure 5 combines offensive and defensive performance into one graphic display. Strong performance along both axes lands a manager in the northwest quadrant, while weak performance on both counts places a group in the southeast quadrant. The other two quadrants locate groups with mixed results. With an offensive score of 112 and a defensive score of 85, the hypothetical group has out-performed the benchmark both offensively and defensively and earns a spot in the NW quadrant.

Figure 5



## The Benchmark Equivalence Line (BEL)

Since the benchmark is equal to itself, its offensive and defensive scores are 1.00 and 1.00, or 100 and 100, respectively. Those scores locate the benchmark at the intersection of the horizontal and vertical axes. Suppose, however, we increase the volatility of the benchmark by multiplying all benchmark returns by, say, 1.2. Column D in Figure 6 shows both higher and lower returns for the new benchmark-as-target (BAT). To compute the offensive score, the BAT's offensive returns are summed and divided by the sum of the original benchmark's returns. The result is 1.2, or an offensive score of 120. Computing the BAT's defensive score yields the same result, 120.

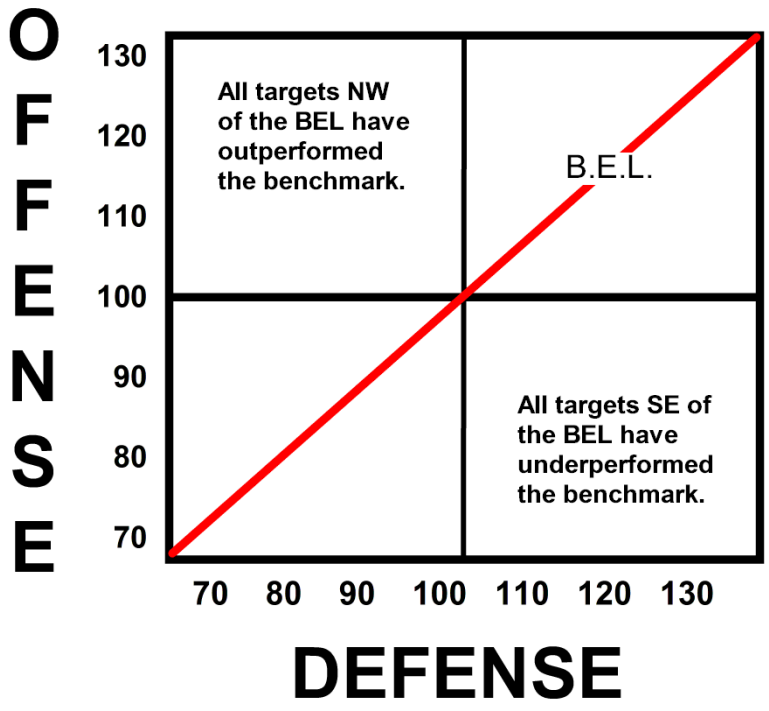
There are infinite combinations of offense and defense which differ in volatility but are equivalent in relative performance. These combinations have offensive and defensive scores which range from extremely weak offense plus very strong defense to the other extreme of excellent offense together with poor defense.

Figure 6

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| | | | | | | |
| | Benchmark | Offensive | Defensive | Benchmark | Target | Target |
| | Returns | Returns | Returns | x 1.2 | Offense | Defense |
| | | | | | | |
| 1 | 2.49 | 2.49 | | 2.99 | 2.99 | |
| 2 | -4.23 | | -4.23 | -5.08 | | -5.08 |
| 3 | 3.63 | 3.63 | | 4.36 | 4.36 | |
| 4 | 1.87 | | 1.87 | 2.24 | | 2.24 |
| 5 | -1.01 | | -1.01 | -1.21 | | -1.21 |
| 6 | 5.76 | 5.76 | | 6.91 | 6.91 | |
| 7 | 3.41 | 3.41 | | 4.09 | 4.09 | |
| 8 | -2.16 | | -2.16 | -2.59 | | -2.59 |
| 9 | -1.49 | | -1.49 | -1.79 | | -1.79 |
| 10 | -0.85 | | -0.85 | -1.02 | | -1.02 |
| 11 | 5.23 | 5.23 | | 6.28 | 6.28 | |
| 12 | 0.03 | | 0.03 | 0.04 | | 0.04 |
| 13 | 3.94 | 3.94 | | 4.73 | 4.73 | |
| 14 | 4.19 | 4.19 | | 5.03 | 5.03 | |
| 15 | -2.61 | | -2.61 | -3.13 | | -3.13 |
| 16 | -0.05 | | -0.05 | -0.06 | | -0.06 |
| 17 | 0.95 | | 0.95 | 1.14 | | 1.14 |
| 18 | 3.85 | 3.85 | | 4.62 | 4.62 | |
| 19 | 2.73 | 2.73 | | 3.28 | 3.28 | |
| 20 | 1.97 | 1.97 | | 2.36 | 2.36 | |

Benchmark-equivalent combinations are arrayed along a southwest-northeast diagonal that passes through the intersection of offensive and defensive benchmarks (100,100) and comprise the Benchmark Equivalence Line (BEL), shown in Figure 7.

Figure 7




Offensive-defensive scores which place a group NW of the BEL demonstrate that it has volatility-adjusted performance better than the benchmark's, while placement SW of the BEL indicates relative performance worse than the benchmark's.

**Calculating Relative Performance**

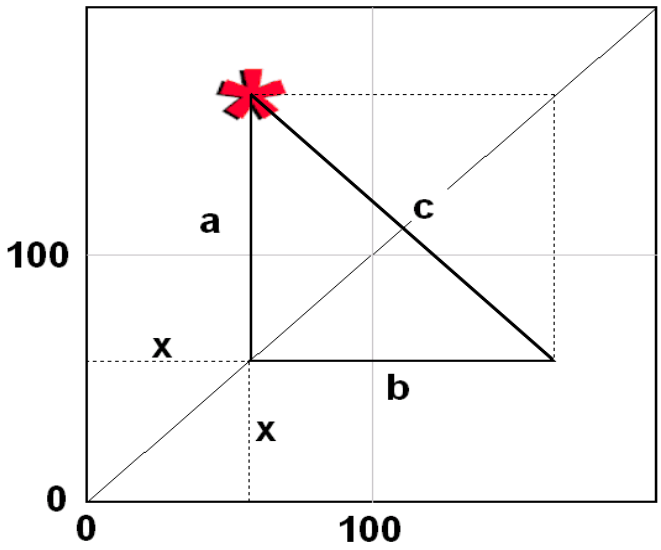
To compute relative strength, a little geometry is required. In Figure 8, a group has excelled both offensively and defensively. From the group's position in the matrix, I have drawn a square with NE and SW corners anchored on the BEL. Diagonal C is the hypotenuse of triangle ABC. A is equal to the target's offensive score minus X, or the target's defensive score. A and B are equal.

Since we know the lengths of A and B, the value of C is determined from the Pythagorean Theorem, $A^2 + B^2 = C^2$. The target's relative strength is measured as its distance from the BEL, or one half of C. The formula for the absolute value of RS is

$$\frac{\sqrt{A^2 + B^2}}{2}$$

If the offensive score is greater than the defensive score, then the target lies to the NW of the BEL and RS is positive, otherwise RS is negative.

Figure 8




**Feedback**

There are two sorts of feedback--positive and negative. A spreading fire is an example of positive feedback. A discarded match ignites the carpet. Left unattended, the fire reaches the curtain and climbs the wall. Soon the entire room is in flames. The fire continues to build until the house burns down or the fire department puts the fire out. Positive-feedback systems exhibit accelerating trends that persist until either system resources are exhausted or the process is checked.

An example of negative feedback is the thermostat, which regulates room temperature by cooling as ambient temperature rises and heating as temperature falls. The thermostat stabilizes room temperature within a comfortable zone.

Negative feedback regulates the balance between predator and prey populations. An increase in the predator population puts pressure on the prey population. A consequent fall in the number of available prey reduces the number of predators that may feed successfully and depresses the predator population. A decline in predators, in turn, boosts the prey population, and so on. The interaction of predator and prey tends to stabilize both populations. Negative-feedback systems are self-regulating, stable systems, with values fluctuating within a narrow range.

When traders respond to market events, they are closing a feedback loop. The actions of individual traders collect to produce changes in the market, and those changes prompt a collective response. In the case of positive feedback during an advancing market, rising prices trigger net buying on the part of the aggregate trader. Net demand boosts prices, and higher prices, in turn, prompt further bids. An accelerating advance results. Positive feedback in a

falling market, on the other hand, develops when declining prices induce traders to sell. Net selling pushes prices down, and lower prices encourage additional offerings. The result is an accelerating decline. Positive feedback, when it occurs, generates a trend. Traders' behavior during these periods may be characterized as 'trend-following'.

At other times, the reverse is true. Traders then trade against the crowd, and feedback between market inputs and traders' aggregate response turns negative. When negative feedback prevails, the composite trader reacts to rising prices by taking profits. Net selling puts pressure on prices. However, falling prices encourage traders to hunt for bargains among depressed issues. Bids for weakened stocks lift prices, and the cycle repeats.

When traders' behavior is predominantly contrarian, negative feedback drives traders' response to price change, and price action is typically corrective.

While contrarians and trend-followers subscribe to very different paradigms, both models are similar in that each offers rules intended to guide traders' response to global market conditions. Each is a manual for feedback.

**Feedback and Capital Flow**

Capital moves from one account to another in thousands of transactions daily, and each transaction adds energy to capital flows. Since no trader is able to control these flows, profits are earned only by properly navigating currents.

During periods of positive feedback, trades buy into strength and sell into weakness. Whether the overall market is rising or falling, capital flows from weaker into stronger issues.

Figure 9

**Capital Flow During Periods of Positive Feedback**

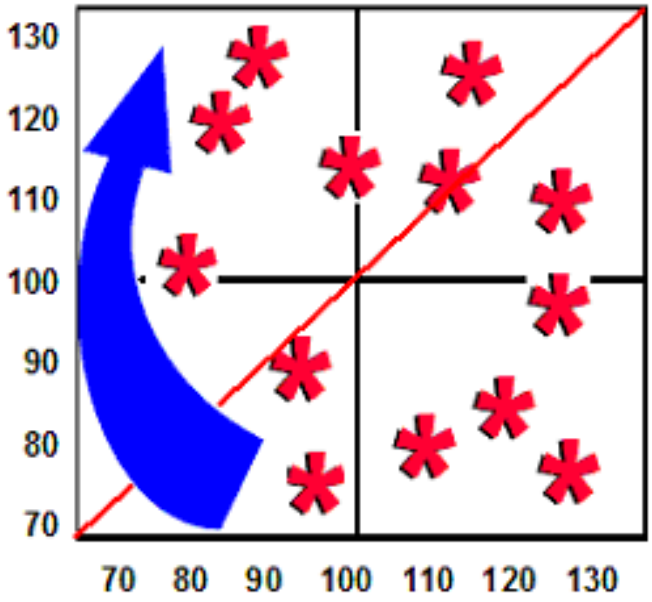


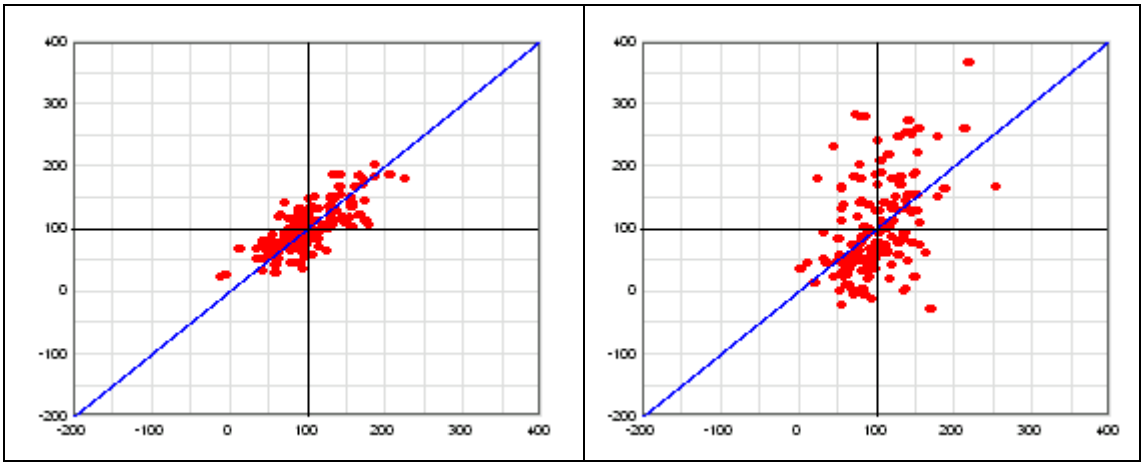
Figure 9 pictures the flow of capital from weak targets SE of the Benchmark Equivalence Line into stronger targets NW of the BEL.

Positive feedback pumps capital into targets NW of the BEL, and, as a result, the strongest targets migrate further toward the NW. Laggards, on the other hand, come under relative selling pressure. As capital drains from weak targets SE of the BEL, laggards lose relative strength and move toward the SE. Positive feedback in both rising and falling markets produces a northwesterly flow of capital and causes the universe of targets to expand.In the next set of charts, the relative performance of 150 industry groups (see Appendix) are plotted against the offensive-defensive matrix over successive periods. The first snapshot was taken in October 1998. The market had corrected after rallying early in the year, and as the rally paused, groups in the universe aligned along the BEL. This is a picture of a market at rest. The major differences to be detected are those based on volatility, not on relative strength (Figure 10). Refreshed after a period of indolence, the market again reached for new highs in November 1999, as bullish traders bid strong groups to extremes of relative strength. Laggards rallied, but not as well, and so drifted to the SE below the BEL. As a result, the spread between the strongest and weakest groups widened.

Figure 10

**Positive Feedback Expands the Universe**

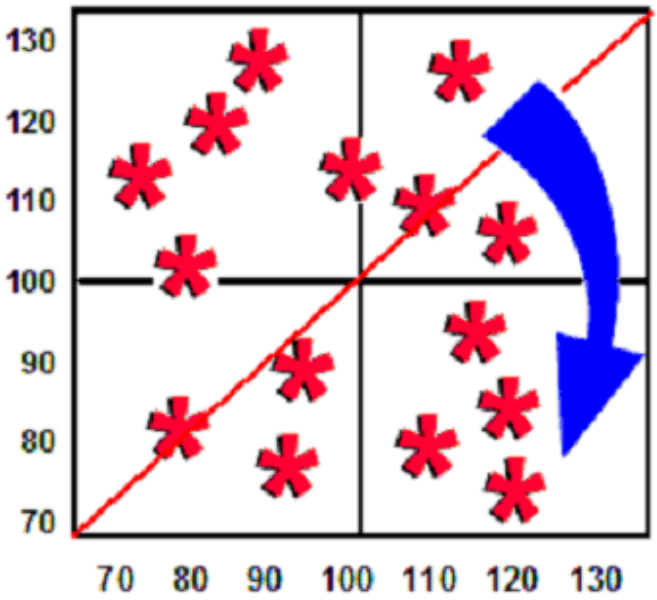
**October 1998** **November 1999**




When feedback turns negative, capital flow across the BEL is reversed. During these periods, traders exhibit contrarian behavior. Contrarian traders offer stocks which are relatively strong and bid for relative-performance laggards. As a result, capital flows out of stronger issues and into weaker issues. (Figure 11).

Figure 11

**Capital Flow During Periods of Negative Feedback**



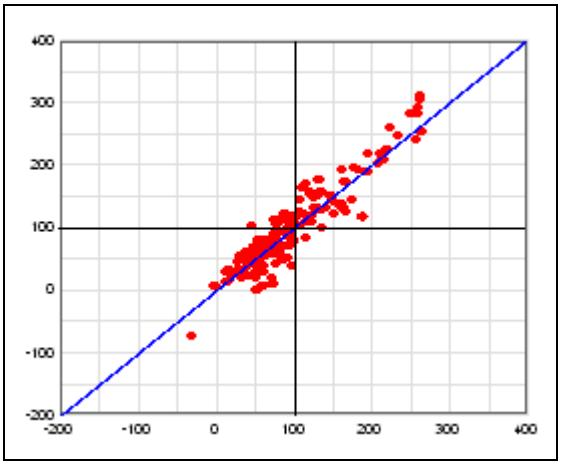

Driven by negative feedback, targets that have been strong lose relative strength, while targets with a recent history of weakness, impelled by infusions of capital, move in a northwesterly direction toward the BEL. Both strong and weak targets migrate toward the BEL as negative feedback contracts the universe.

After peaking in 2000, the market corrected during 2001. Bids for stronger stocks were relaxed and the universe contracted. By December groups were huddled along the BEL (Figure 12).

Figure 12

**Negative Feedback Contracts the Universe**

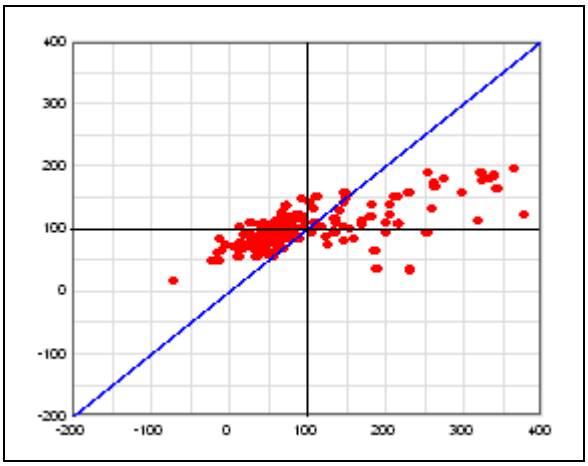
**December 2001**



However, the decline soon resumed, this time with more urgency. Traders shed or shorted weak groups aggressively, and by June 2002 the weakest groups were far to the SE of the BEL. Now bearish, traders had again driven the strongest and weakest groups apart.

Figure 13

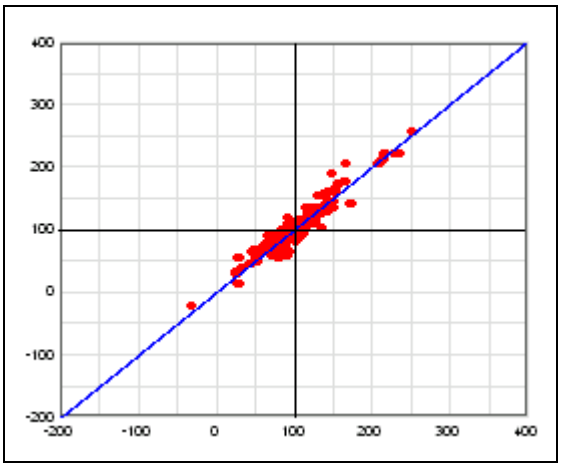
**June 2002**




The market reached its low in the summer of 2002, and by December the market had been consolidating for six months. Differences based on relative strength narrowed as both stronger and weaker groups were held within a range. Once more at rest, groups lined up along the BEL (Figure 14).

Figure 14

**December 2002**




The current of capital alternates back and forth in a cycle repeated again and again as the universe of stocks expands then contracts. But what is it that prompts traders, as if with one mind, to push stocks to relative-strength extremes before pulling them back toward the benchmark?

It is confidence, or lack of confidence, in the immediate direction of price. Of course we can't measure confidence directly in a price-based system, but if we are to speculate about traders' motivations at all, then confidence is a disposition which fits the facts nicely.

Confidence in this context may be seen as the progressive raising of expectations. When traders, for whatever reasons, defer profits and chase strong stocks into new high ground, they exhibit bullish confidence. When that confidence is rewarded, expectations are raised, buying intensifies, trends develop and accelerate, and profits, for those trading with the trend, come easily. When traders-in-the-aggregate demonstrate confidence in declining prices, weak stocks are liquidated, and proceeds are either shifted to stronger stocks that defend well in a falling market, held in cash, or applied to shorts. Price direction is durable, albeit negative, and traders benefit by selling into weakness.

In either case, confidence in the direction of price is evidenced by trend-following behavior. The controlling dynamic is positive feedback, and the universe expands.

As the trend proceeds, traders' expectations adapt to fit recent experience. At some point, however, stored capital is used up, and exhaustion sets in, analogous to fatigue in biological systems. These conditions provide an opening for countervailing forces, which rise to check the trend. In either case, increased expectations cannot be met. Once traders lose confidence in the immediate direction of price, the dynamic changes. Now risk-averse and contrarian, traders take profits quickly in stocks that have rallied and focus bids on fallen laggards. During periods of contrarian control, price trends are short-lived, and profits become elusive. Contrarian periods lower traders' expectations/confidence and set the stage for the next period of expansion.

## Part II

## Structure and Entropy

> *The prime mover in a financial market is not value or price, but price differences: not averaging, but arbitraging.*
>
> Benoit Mandelbrot[8]

All structure involves differentiation. One note played over and over is noise, not music. However, play one note, then another, and sound becomes something more. The structure of music emerges in the space between the notes, in their difference. An office tower is a monument to differentiation. The common stuff of earth is separated, refined and shaped into distinct structures which are ultimately joined to create an even grander structure. When traders

exhibit trend-following behavior, positive feedback widens relative strength differences among groups. The process of expansion may be viewed as an evolution toward increased structure.

When traders turn contrarian, however, the opposite effect is seen. Strong groups are offered and weaker groups receive a preferential bid. As a result, both stronger and weaker groups migrate toward the benchmark, and structures built up during the process of differentiation collapse.

> ***en·tro·py:*** *the tendency for all matter and energy in the universe to evolve toward a state of inert uniformity; the inevitable and steady deterioration of a system or society.*
>
> The American Heritage Dictionary

A new deck of cards is structured by suit and rank. Given a fresh deck, even untutored players can beat the dealer. Shuffling reduces structure and increases randomness. Cards are routinely shuffled during games of chance in order to eliminate any advantage to card counters provided by structure. As shuffling reduces structure, randomness--or perhaps better, entropy--increases. Entropy is the propensity for differences to collapse toward equilibrium, for structure to decay, to incline toward disarray, disorder and degeneration.

Entropy increases as negative feedback contracts industry groups toward equilibrium at the BEL. Critical information stored as relative-strength differences erodes until there is little remaining in the recent performance of various groups to distinguish one from another. As a consequence, the perceived benefit of picking one alternative over another diminishes. This is just the situation one faces in a game of chance when presented with more or less equally likely alternatives. An increase in entropy implies an increase in randomness, that is, a decrease in information and, thus, a decrease in confidence with respect to outcomes.

> *The place of greatest meaning hovers exactly between order and randomness.*
>
> J. R. Pierce[9]

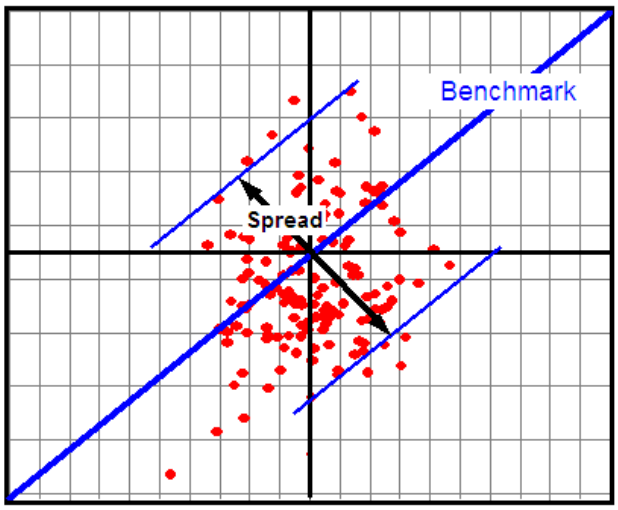
The market exists at the boundary between opposing forces that drive positive and negative feedback. The battle line is constantly drawn and redrawn between competing paradigms, one pushing the system toward regeneration and structure and the other pulling conditions back toward entropy and equilibrium.

Any relative-strength strategy is based on advantages offered by structure. When positive feedback expands the universe, new structures based on relative strength emerge from the randomized pile left after the most recent period of contraction. Since reorganization of the market takes time, traders are able to profit by recognizing increasing differentiation among industry groups in time to place bets. The emergence of structure is the trend.

## The Spread

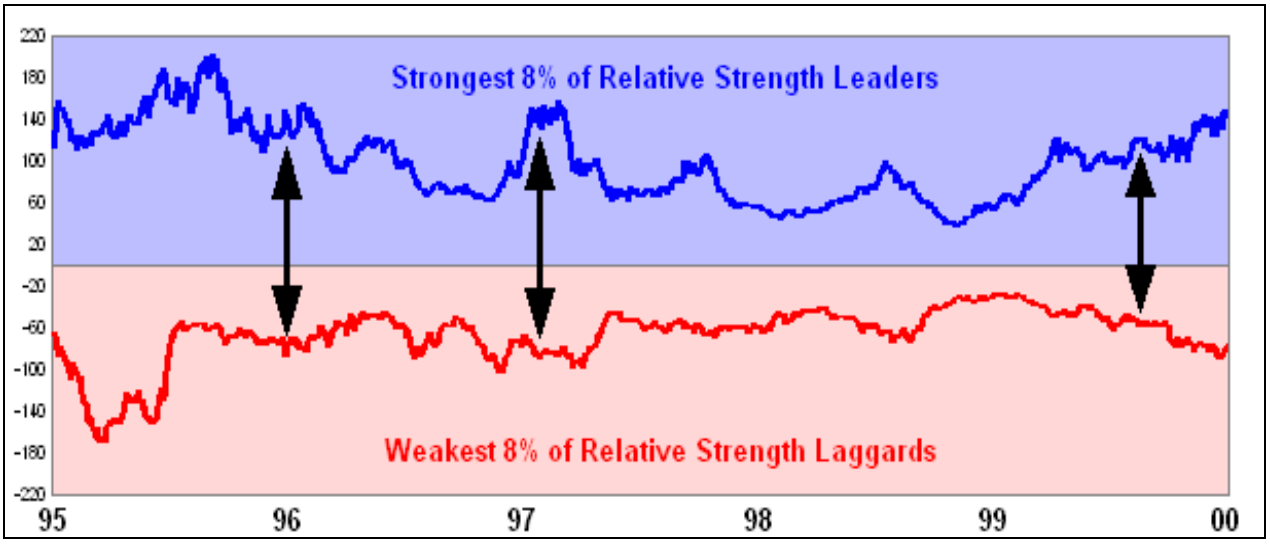
The Spread measures the distance between the average of strong targets near the leading edge of expansion and the average of weak targets at the nether frontier of the universe (Fig 15).

Figure 15




To calculate the Spread, relative strength readings of the weakest groups are averaged and subtracted from the average RS of the strongest groups. This study averages the strongest and weakest eight percent of all groups in the universe. Figure 16 displays a running account of the RS spread from 1995 to 2000.

Figure 16

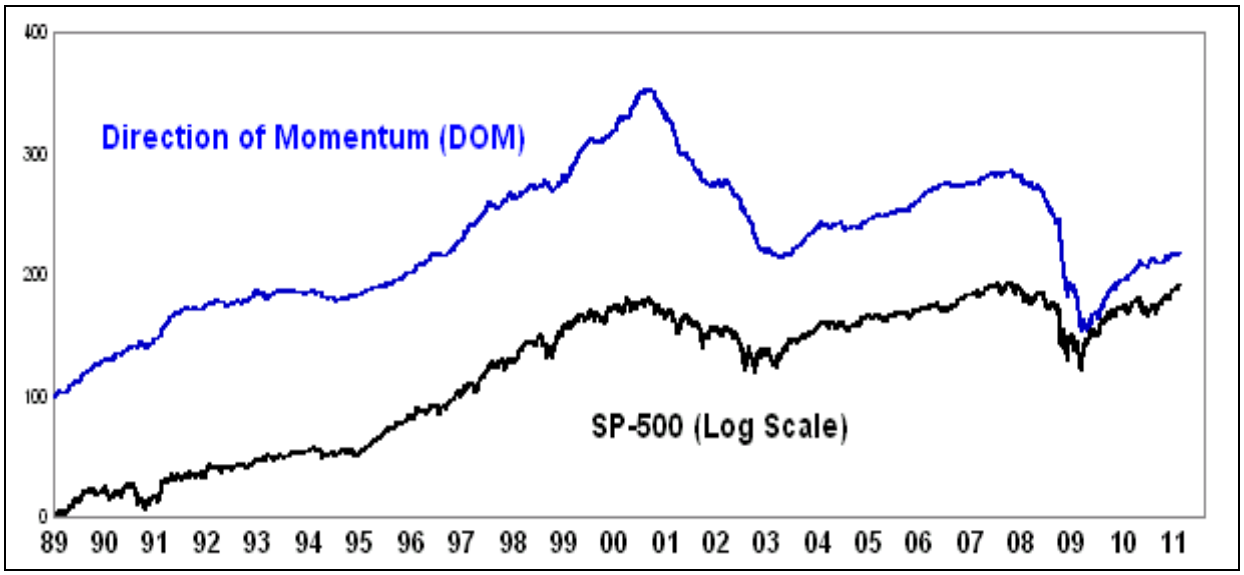



## The Direction of Momentum

If it is positive feedback that most directly contributes to the emergence of market structures, then there may be a benefit in focusing on just those periods when positive feedback is the controlling dynamic. To determine the direct impact of positive feedback on the broad

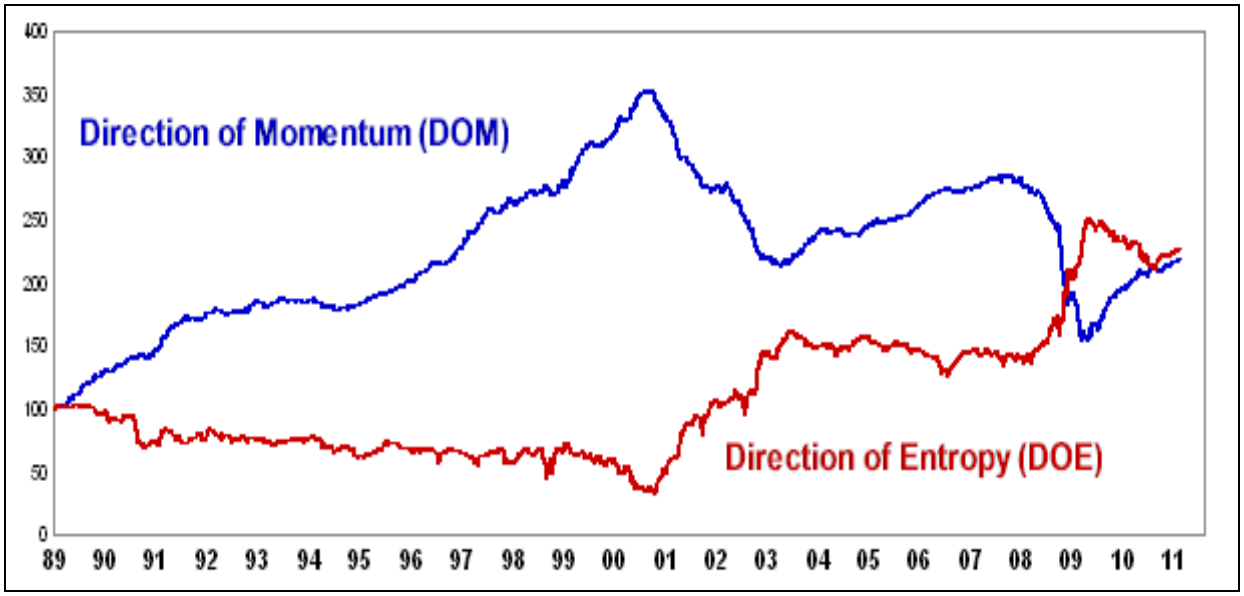
market, the first study below logs changes in the SP-500 only on days when the RS spread expands. Entropic episodes, i.e., days on which negative feedback contracts the universe, are ignored. The running sum of those changes yields the SP-500's Direction of Momentum (DOM). *DOM reveals the direction in which positive feedback (momentum) is driving the trend.* Figure 17 compares the SP-500's DOM and the index from January 1989 through mid-February 2011.

Figure 17




A separate series, the Direction of Entropy (DOE), cumulates price changes for the remaining days, those on which the Spread contracts. Since contrarians are negative-feedback traders, DOE shows overall market direction under contrarian control. Figure 18 compares the SP-500's DOM and DOE.

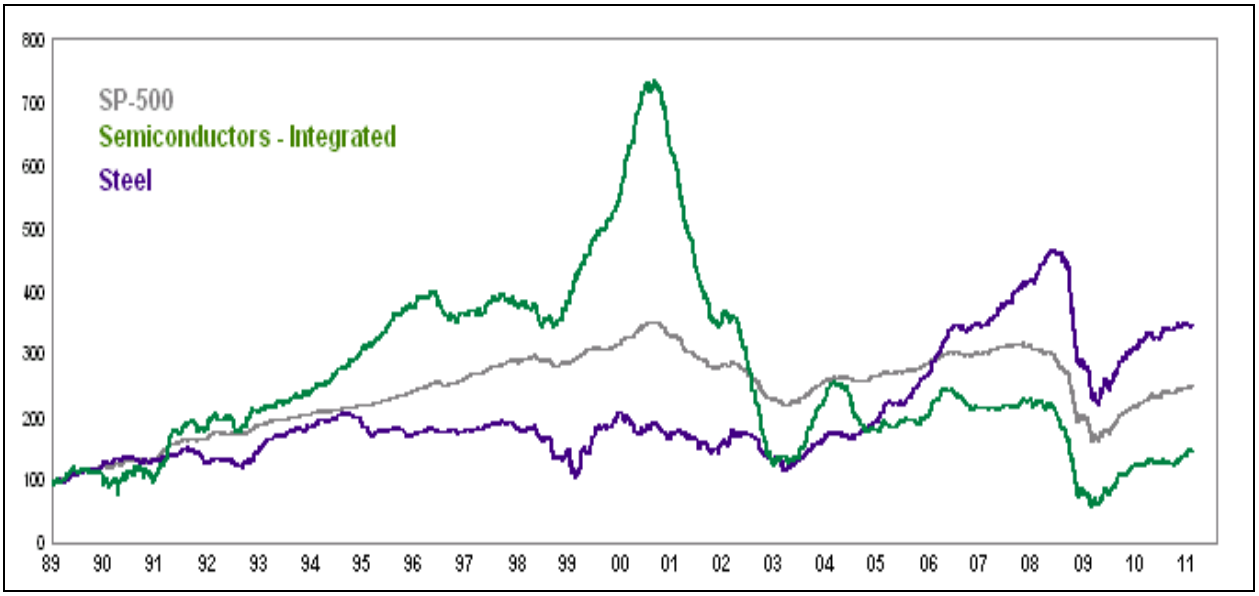
Figure 18



Note that DOE runs against DOM as well as against the broad trend of the market. Contrarian are counter-trend traders, who by their actions provide a check on momentum and, in effect, regulate the pricing system. Without the entropy introduced by contrarians, the market would be at risk of runaway, and possibly terminal, positive feedback.

The direction of momentum may be determined for any price series. Figure 19 shows the direction of momentum for the SP-500 (gray), along with that of the integrated semiconductor group (green) and the steel group (purple) over the last two decades.

Figure 19

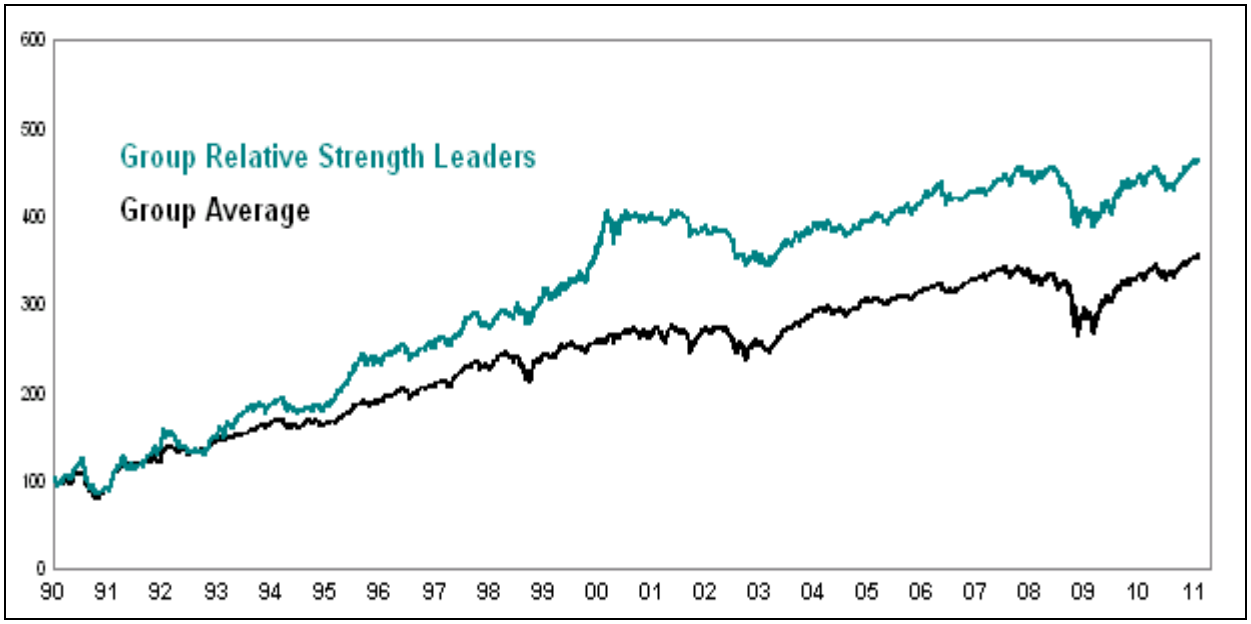



Compare the DOMs of the semiconductor and steel groups. Prior to the 2000 market peak, semis made a strong momentum-driven advance relative to steel before falling precipitously into late 2003. Then, steel outpaced semiconductors in an unbroken momentum-driven charge from the 2003 market low to a twenty-year momentum high in 2008. Clearly, not all DOMs are alike. Positive feedback affects different groups differently over the same period. Why not compare the relative effects of momentum? What, if any, advantage over traditional relative strength measures do relative momentum comparisons offer?

**Relative Momentum**

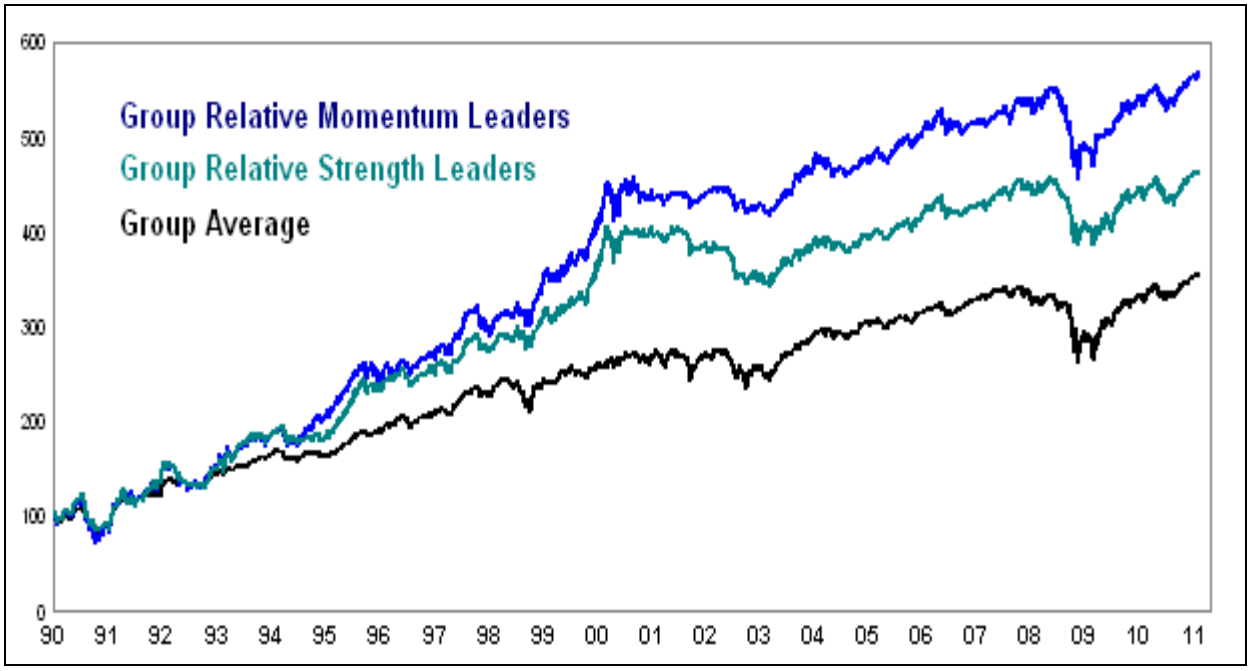
As a baseline for comparison, relative strength is first computed for all groups in the study using a 120-day look-back. To compute forward performance, RS is determined for each group as of day *d* and close-to-close change is computed as of *d+1*. In the next study, the RS forward performance of the strongest eight percent of groups was averaged and compared to the average performance of the entire universe of groups (Figure 20).[10]

Figure 20




To compute RM, the DOM of each group must first be determined. To accomplish this, days on which the RS group spread expands are identified and those days' price changes for each group in the universe are recorded. Changes are then summed over the previous six months to produce the DOM of each group. Finally, the relative performance of each DOM series is calculated daily just as relative strength is calculated for each complete price series. In Figure 21, the daily forward performance of the strongest RM groups is averaged and compared to the forward performance of the strongest RS groups as well as to the average of all groups.

Figure 21



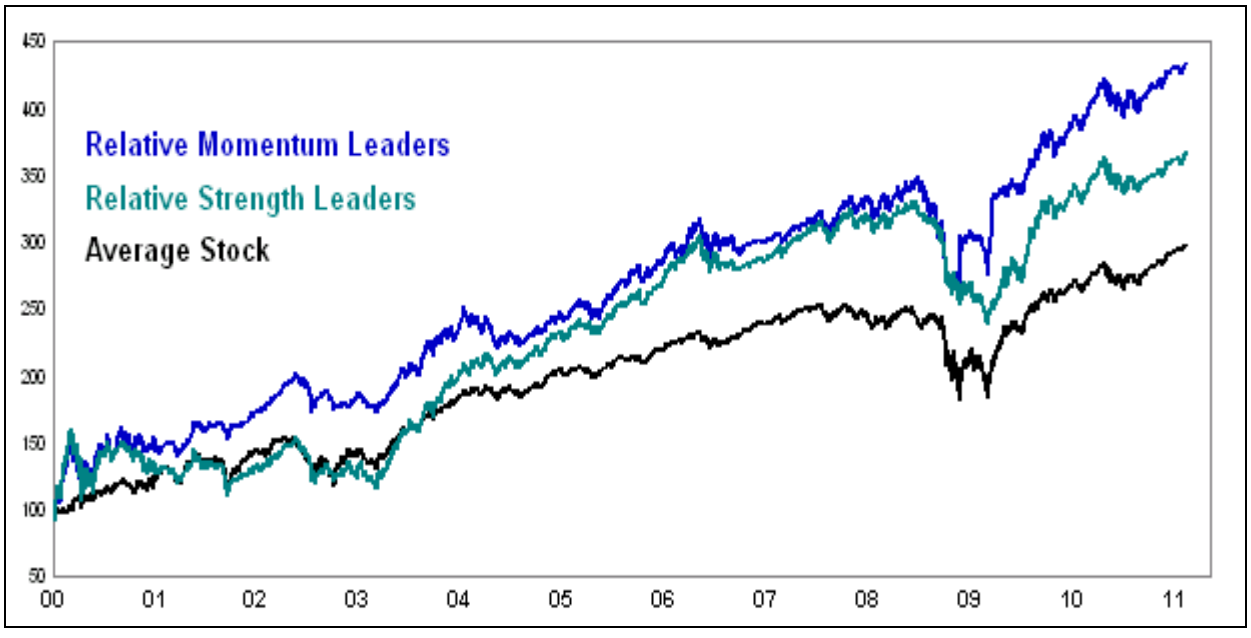
The forward performance of relative strength leaders exceeded the group average over the twenty-one plus years included in the study. The average annual compounded rate of growth of RS leaders is 15.5%, against 11.0% for the group average. RM leaders outperformed both the group average as well as RS leaders, scoring annual compounded growth of 20.1%.

Group averages represent the broader themes which animate traders. Perhaps for that reason, relative strength works well when applied to groups. Moskowitz and Grinblatt demonstrated that "industry momentum strategies are more profitable than individual stock momentum strategies."[11] Will the same RS/RM techniques yield similarly positive results over a universe of individual stocks?

600 stocks were randomly distributed into four sets of 150. RS leaders and RM leaders of each set were computed using closing price data from January 2000 to February 2011. Since "industry momentum drives much of individual stock momentum,"[12] positive and negative feedback days determined for groups were carried over to the study of individual stocks.

In each set of stocks, RS leaders outperformed the average stock over eleven-plus years, and RM leaders generated forward returns superior to that of RS leaders. Figure 22 compares the average log-scale performance of all four sets of RS and RM leaders, as well as the sum of average daily changes for all 600 stocks. The average annual compound rate of return of RS leaders is 18.0% versus 13.7% for the group average. Relative momentum leaders topped both series with an annual return of 23.2%.[13]

Figure 22



## Concluding Notes

The market is the sum of countless independent agents acting out of blinkered self-interest. Nevertheless, the market does not dissolve into chaos, but self-organizes in a dialectic of opposing forces, one emergent and creative, the other regulative and entropic. The resulting dynamic never settles fully and finally into either a trend-following or contrarian mode, but constantly fluctuates between the two.

There is support in the literature for the idea that self-organizing systems not only tolerate but require both thesis and antithesis. Among the more interesting, Boids, a computer program developed by Craig Reynolds in 1986, simulates the flocking of birds. Flocking is a particularly instructive case of emergence, in which, as Reynolds found, complex global behavior arises from the interplay of just a few simple rules. To create life-like flocking behavior, Reynolds needed only three steering commands:

> **Cohesion**: steer toward the average position of surrounding flockmates;
> **Alignment:** steer toward the average heading of local boids;
> **Separation**: steer away from nearest neighbors to avoid collisions.[14]

The first two call for individual boids to imitate the behavior of the flock, while the third requires that each boid evade the flock by steering away from nearby flock mates. Complex flocking behavior, then, may be adequately depicted as the interaction of two distinct motions. "Natural flocks seem to consist of two balanced, opposing behaviors: a desire to stay close to the flock and a desire to avoid collisions within the flock."[15]

Christian Fuchs makes the larger point:

> The dialectic of attraction and repulsion is a description of dynamic movement that produces emergent qualities on higher levels of organization.[16]

RM works because the method successfully taps the unique force that accounts for trends in an ongoing dialectic, while ignoring influences which attenuate trends. Based on results, RM is proposed as an alternative to RS techniques now commonly in use.

Endnotes

[1] George A. Chestnutt, Jr., *Stock Market Analysis: Facts and Principles*, American Investors Corporation, 1965.

[2] Levy, Robert, *The Relative Strength Concept of Common Stock Price Forecasting*, Investors' Intelligence, 1968.

[3] Jegadeesh N. and Titman S., "Returns to Buying and Selling Losers: Implications for Stock Market Efficiency", Journal of Finance, March, 1993.

[4] Brozynski T., Menkhoff L. and Schmidt U., "The Use of Momentum, Contrarian and Buy-&-Hold Strategies: Survey Evidence from Fund Managers", Univ. of Hannover, December, 2003.

[5] Grinblatt M., Titman S. and Wermers, R., "Momentum Investment Strategies, Portfolio Performance and Herding", American Economic Review, December, 1995.

[6] Gary Anderson, "The Janus Factor", MTA/Dow Jones, 2003.

[7] A benchmark may be an index or the average of any groups or stocks under analysis.

[8] Benoit Mandelbrot, *The (Mis)Behavior of Markets*, Basic Books, 2004.

[9] J.R. Pierce, *Symbols, Signals, and Noise*. New York, NY: Harper and Row, 1961.

[10] All charts are log scale. RS leadership is updated daily. Portfolios are equally dollar balanced each day, and daily change of the average group is determined by averaging the changes of all groups.

[11] Tobias Moskowitz and Mark Grinblatt, "Do Industries Explain Momentum", *The Journal of Finance*, Fifty-Ninth Annual Meeting of the American Finance Association, New York, 1999.

[12] Moskowitz, Ibid

[13] While the methods presented here are of practical value to traders, returns generated by long-term analyses of groups and stocks are not intended to reflect real-world results. However, inputs which contribute to RM's enhanced returns cannot otherwise be gauged except through computation of hypothetical outcomes.

[14] Craig W. Reynolds, "Flocks, Herds and Schools: A Distributed Behavioral Model", Computer Graphics, Vol 21, Number 4, July 1987.

[15] Reynolds, Ibid.

[16] Christian Fuchs, "The Self-Organization of Matter", Nature, Society, and Thought, vol. 16, no. 3 (2003)

Appendix

150 Morningstar industry group indexes supplied by Telechart were used in this study:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| MG111 | MG312 | MG333 | MG425 | MG522 | MG628 | MG722 | MG742 | MG811 | MG833 |
| MG113 | MG313 | MG334 | MG431 | MG523 | MG629 | MG723 | MG747 | MG812 | MG834 |
| MG114 | MG314 | MG341 | MG432 | MG525 | MG631 | MG724 | MG761 | MG813 | MG835 |
| MG121 | MG315 | MG342 | MG433 | MG526 | MG632 | MG726 | MG762 | MG814 | MG836 |
| MG122 | MG316 | MG343 | MG434 | MG527 | MG633 | MG727 | MG763 | MG815 | MG837 |
| MG123 | MG317 | MG344 | MG441 | MG529 | MG634 | MG728 | MG764 | MG816 | MG838 |
| MG124 | MG321 | MG345 | MG448 | MG611 | MG635 | MG729 | MG765 | MG822 | MG841 |
| MG125 | MG322 | MG346 | MG511 | MG612 | MG636 | MG731 | MG766 | MG823 | MG842 |
| MG126 | MG323 | MG349 | MG512 | MG621 | MG638 | MG732 | MG767 | MG824 | MG843 |
| MG131 | MG324 | MG351 | MG513 | MG622 | MG712 | MG733 | MG771 | MG825 | MG845 |
| MG133 | MG325 | MG411 | MG514 | MG623 | MG713 | MG734 | MG772 | MG826 | MG847 |
| MG134 | MG326 | MG414 | MG515 | MG624 | MG714 | MG735 | MG774 | MG827 | MG853 |
| MG135 | MG327 | MG419 | MG516 | MG625 | MG715 | MG736 | MG775 | MG828 | MG912 |
| MG136 | MG331 | MG421 | MG517 | MG626 | MG717 | MG737 | MG776 | MG831 | MG913 |
| MG311 | MG332 | MG423 | MG521 | MG627 | MG721 | MG739 | MG777 | MG832 | MG914 |

Stocks:

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AA | AVB | CERN | DDS | FITB | HPQ | KO | MS | PBCT | RGLD | STLD | UNH |
| AAPL | AVP | CFR | DE | FL | HPT | KR | MSFT | PBI | RHI | STR | UNM |
| ABFS | AVY | CHD | DECK | FLEX | HRB | KSS | MT | PCAR | RIG | STRA | UNP |
| ABX | AXP | CHKP | DELL | FLIR | HRL | LAMR | MTW | PCG | RIO | STT | UNT |
| ACE | AZN | CHRW | DF | FLS | HSC | LCC | MU | PCH | RJF | STZ | URBN |
| ACI | AZO | CI | DHI | FMC | HSIC | LEG | MUR | PCP | RKT | SVU | USB |
| ACXM | BA | CIEN | DIS | FO | HST | LEN | MWW | PEG | RL | SWC | USG |
| ADBE | BAC | CINF | DISH | FOSL | HSY | LH | MYGN | PENN | RMBS | SWK | UTX |
| ADM | BAP | CKH | DLTR | FRT | HTLD | LIZ | MYL | PETM | RMD | SWKS | UVV |
| ADP | BAX | CL | DNB | FSYS | HUM | LLTC | NAT | PFE | ROK | SWM | VAL |
| ADSK | BBBY | CLB | DO | FTO | IACI | LLY | NBL | PG | ROP | SWY | VAR |
| ADTN | BBT | CLF | DOV | FTR | IBM | LMT | NBR | PGN | ROVI | SYK | VCI |
| AEP | BBY | CLP | DOW | GCI | IDCC | LNC | NCR | PH | RPM | SYMC | VECO |
| AET | BCO | CLX | DPL | GDI | IDTI | LNCR | NEM | PII | RRC | T | VFC |
| AF | BCR | CMC | DRI | GDP | IDXX | LNT | NEU | PIR | RRD | TAP | VMC |
| AFL | BDX | CMCSA | DRQ | GE | IEX | LOGI | NFG | PKX | RS | TCB | VMI |
| AGN | BEAV | CMCSK | DTV | GENZ | IFF | LOW | NKE | PL | RSH | TDW | VRTX |
| AGU | BGC | CMI | DUK | GET | IGT | LPX | NLY | PLCM | RTI | TEX | VRX |
| AIG | BID | CMO | DV | GFI | INCY | LRCX | NOC | PLL | RYAAY | TFX | VSH |
| ALB | BIG | CMTL | DVA | GG | ING | LSCC | NOK | PLT | RYL | TGT | VVUS |
| ALK | BKE | CNI | EAT | GGG | INTC | LSI | NOVL | PLXS | SAFM | THC | VZ |
| ALKS | BKS | CNP | ECL | GILD | INTU | LTD | NSC | PMCS | SAM | THO | WAB |
| ALTR | BMO | COF | EFX | GIS | IP | LUFK | NSM | PMI | SANM | TIE | WAG |
| ALU | BMS | COO | EGN | GLW | IPG | LUK | NST | PNR | SAPE | TIF | WERN |
| AMAG | BP | COP | EK | GMT | IR | LUV | NTAP | PNRA | SBUX | TIN | WFMI |
| AMAT | BRS | CP | ELN | GNTX | IRF | LXK | NTRS | POM | SCCO | TK | WFR |
| AMD | BVN | CPRT | ELX | GPC | IRM | LZ | NU | POT | SCHW | TKR | WFSL |
| AME | BWA | CPWR | EMC | GPS | ITRI | M | NUAN | PPS | SEIC | TLB | WHR |
| AMED | BXP | CR | EME | GR | ITW | MAN | NUE | PRE | SFD | TM | WL |
| AMGN | BYD | CREE | EMN | GSK | JACK | MAS | NVLS | PRGO | SHOO | TMK | WLT |
| AMLN | C | CRR | EMR | GT | JAH | MAT | NVO | PRX | SIVB | TMO | WM |
| AMSC | CAG | CRUS | EP | GTI | JBHT | MBI | NWL | PSA | SKM | TMX | WMB |
| AMTD | CAKE | CRZO | EQR | GVA | JCI | MCD | NWS | PSS | SKS | TOL | WMS |
| AMZN | CAM | CSC | EQT | GXP | JCP | MD | NYT | PTEN | SLB | TRH | WMT |
| AN | CAR | CSCO | ERIC | HAL | JDAS | MDC | OI | PVH | SLGN | TRMB | WNC |
| ANF | CASY | CSH | ERTS | HANS | JDSU | MDP | OII | PWER | SLM | TRN | WPI |
| ANN | CAT | CSTR | ESL | HAR | JKHY | MDR | OKE | PX | SMG | TROW | WPO |
| AOS | CBD | CSX | ESRX | HAS | JNJ | MDT | OLN | Q | SNA | TSN | WRLD |
| APD | CBE | CTB | ESV | HCC | JPM | MEE | OMC | QCOM | SNDK | TTC | WSM |
| APH | CBI | CTXS | ETN | HD | JWN | MGA | OMX | QGEN | SNE | TTWO | WTNY |
| APOL | CBRL | CVA | ETP | HL | K | MGM | ORCL | QLGC | SNPS | TV | WTR |
| ASH | CBS | CVD | EXPD | HMA | KBH | MHK | ORI | QSII | SO | TWX | WY |
| ASML | CBST | CVH | F | HMC | KEY | MHP | ORLY | R | SON | TXI | X |
| ASNA | CBT | CVS | FAST | HMSY | KGC | MI | OSG | RAH | SPLS | TXN | XLNX |
| ATK | CCE | CY | FCX | HMY | KIM | MICC | OSK | RCI | SPW | TXT | XOM |
| ATML | CCJ | CYN | FDO | HNT | KLAC | MMM | OTEX | RCII | SQM | TYC | XRAY |
| ATO | CDE | CYT | FDS | HNZ | KLIC | MO | OXY | REG | SRCL | UHS | XRX |
| ATVI | CELG | DB | FDX | HOC | KMP | MOLX | PAAS | REGN | SRE | UIS | YHOO |
| ATW | CENX | DBD | FINL | HOG | KMT | MOS | PAG | REP | STE | UL | YUM |
| AUY | CEPH | DCI | FISV | HOV | KMX | MRK | PAYX | RGA | STJ | UN | ZION |